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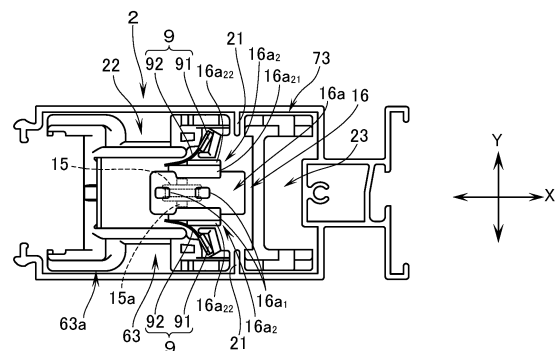
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(54) **SCREEN APPARATUS**

(57) A tension member 8 formed into a loop is disposed in a Z-axis direction, an inside of a slidable frame 2 is divided into a first storage portion 22 for storing a first guide 6 at one side in the X-axis direction and a second storage portion 23 for storing a second guide 7 at the other side in the X-axis direction, both the first storage portion 22 and the second storage portion 23 allow the tension member 8 to pass, a direction changing member 15 on which the tension member 8 is hung and which causes a direction of the tension member 8 to change in the Z-axis direction is provided in each of the insides of one end portion and the other end portion in the Z-axis direction of the slidable frame 2, one of the direction changing members 15 is disposed through a supporting member 16 at one end portion in the Z-axis direction of the first storage portion 22, a pair of relieving pieces 16a₂, 16a₂ extending in the Z-axis direction and opposing to each other in a Y-axis direction are provided with the supporting member 16, and each of the relieving pieces 16a₂ comes into contact with needle-like parts 92 of each of screen retaining members 9 and causes the needle-like parts 92 to bend so as to move away from the supporting member 16 in a Y-axis direction when the first guide 6 is drawn from and stored in the first storage portion 22.

FIG.10



Description

Technical Field

[0001] The invention relates to a screen apparatus adaptable to a net door, a partition and the like, as well as a shading and dimming means such as a curtain, a blind and the like.

Background Art

[0002] Conventionally, the screen apparatus of this kind generally includes a screen that can be freely expanded and stored; on a premise that an expansion and storage direction of the screen is defined as an X-axis direction in orthogonal three axes including the X-axis, a Y-axis, and a Z-axis, a pair of frames consisting of a first frame and a second frame, at least one of which is a slidable frame in the X-axis direction, which are longitudinal in the Z-axis direction and hollow, and which are disposed opposite to each other in the X-axis direction; a first guide and a second guide each of which has a free end at an end, and which are drawn from an inside of the slidable frame when the slidable frame is slid to one side in the X-axis direction and are stored in the inside of the slidable frame when the slidable frame is slid to the other side in the X-axis direction; and a tension member that is stored in the inside of the slidable frame and connects the free ends of the first guide and the second guide. In the screen apparatus, one end in the X-axis direction of the screen is fixed to the first frame and the other end in the X-axis direction of the screen is fixed to the second frame, a portion of the first guide, which is drawn from the inside of the slidable frame, extends linearly in the X-axis direction between one end portions in the Z-axis direction of the pair of the frames, and a portion of the second guide, which is drawn from the inside of the slidable frame, extends linearly in the X-axis direction between the other end portions in the Z-axis direction of the pair of the frames.

[0003] As one of such the screen apparatuses, there has been known a screen apparatus in which the first guide is formed by connecting a plurality of first guide units, each of the first guide units includes a pair of side walls disposed opposite to each other in the Y-axis direction when the first guide is drawn from the inside of the slidable frame and a bottom wall connecting both of the side walls, one of two adjacent first guide units is pivotally supported by the other, whereby the first guide not only bends to the other side in the Z-axis direction but also maintains linearity in the X-axis direction, and one end portion in the Z-axis direction of the expanded screen is inserted between both of the side walls of each of the first guide units in the portion of the first guide, which is drawn from the inside of the slidable frame (See Patent document No. 1, for example).

[0004] In the above-mentioned screen apparatus, a pair of pins directing inward in an opposite direction of

both of the side walls are provided with one end parts in the X-axis direction of both of the side walls of each of the first guide units, which correspond to one end portion in the Z-axis direction of the first guide and which are drawn from the slidable frame, and a pair of openings are opened in the other end parts in the X-axis direction of both of the side walls. Two first guide units are connected to each other by causing each of the pins of the other of the first guide units to loosely fit in each of the openings of one of the first guide units, both of the pins form a pivot, and each of the first guide units are pivotally movable.

[0005] Further, a rigid protrusion protruding inward in the opposite direction of both of the side walls is provided with a part of both of the side walls of each of the first guide units, which is disposed at a side of which each of the above-mentioned pins is provided. Each of the rigid protrusions, in the first guide, is disposed along an imaginary line that connects a pivot center of each of the first guide units in a connecting direction of the first guide units. The above-mentioned rigid protrusions stab the one end portion in the Z-axis direction of the screen, which is inserted between both of the side walls of each of the first guide units in a drawn portion of the first guide when the first guide is drawn to the other side in the X-axis direction accompanying sliding of the slidable frame to one side in the X-axis direction. If the expanded screen receives external forces such as a wind pressure, the rigid protrusions hold the one end portion in the Z-axis direction of the screen so as to prevent the one end portion in the Z-axis direction of the screen from slipping out of the drawn portion of the first guide.

[0006] However, although the rigid protrusion, each of the first guide units is generally an integrally molded product made of a resin and since the rigid protrusions repeatedly stab and slip out of the one end portion in the Z-axis direction of the screen accompanying expansion and storage of the screen, the rigid protrusions have problems such as deformation due to bending, damage due to breaking, and the like. Additionally, a kind of the screen is generally changed according to a use, an installation site, and the like of the screen apparatus. Accordingly, in a case where a strength of a molding material of the above-mentioned first guide unit is higher than that of the screen, when the above-mentioned rigid protrusions stab the screen, there is some concern that the one end portion in the Z-axis direction of the screen will be damaged. In order to prevent the screen from being damaged, it is necessary in the above-mentioned screen apparatus for the first guide units to be made of a plurality of molding materials each of which corresponds to the kind of the screen. As a result, a kind of the first guide also becomes plural.

[0007] Then, the applicant has proposed that a screen apparatus which can suppress the damage of the one end portion in the Z-axis direction of the screen, which is inserted into the first guide, even by repetition of the expansion and storage of the screen and in which the

first guide can be formed by only one kind of the first guide unit in spite of the kind of the screen (Japanese Patent Application No. 2020-038505 (not published at a filing date of the present application)).

[0008] In the above-mentioned screen apparatus, a pair of pins directing outward in the opposite direction of both of the side walls are provided with one end part in the X-axis direction of both of the side walls of each of the first guide units and a pair of openings are opened in the other end parts in the X-axis direction of both of the side walls of each of the first guide units, the two adjacent first guide units are connected by causing each of the pins of the other of the first guide units to loosely fit in each of the openings of one of the first guide units, both of the pins form the pivot, and each of the first guide unit is pivotally movable.

[0009] Additionally, a rail part is provided at inner side parts in the opposite direction of both of the side walls of each of the first guide units, the rail part extends along an imaginary line that connects a pivot center of each of the first guide units in a connecting direction, and a supporting piece protruding inward in the opposite direction of both of the side walls is provided at end edge parts of both of the side walls, which are disposed further from the bottom wall than the rail parts in the Z-axis direction.

[0010] Further, a screen retaining member in which a plurality of needle-like parts aligned at a distance are attached to a longitudinal base that is bendable in a pivotal moving direction of each of the first guide units is detachably attached to an inner side of the opposite direction of both of the side walls of each of the first guide units, in an attached state of each of the screen retaining members, a base is supported between each of the rail parts and each of the supporting pieces of each of the first guide units, and all of the needle-like parts protrude inward in the opposite direction of both of the side walls of each of the first guide units.

[0011] Furthermore, when the first guide is drawn to the other side in the X-axis direction accompanying sliding to one side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members stab the one end portion in the Z-axis direction of the screen, which is inserted between both of the side walls of each of the first guide units in the drawn portion of the first guide, and it is impossible for the screen to slip out of the drawn portion of the first guide, and when the first guide is stored in the inside of the slidable frame accompanying sliding to the other side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members slip out of the one end portion in the Z-axis direction of the screen.

Reference

[0012] Patent document No.1: EP 2333229 A2

Summary of Invention

Technical Problem

[0013] After consideration, there has been found some points which are preferable to be improved in the screen apparatus that has previously proposed. Namely, not only to make the slidable frame slide in parallel with respect to the other frame that is disposed opposite to the slidable frame in the X-axis direction by making a storage length of the first guide and the second guide in the inside of the slidable frame and a drawn length of those of the inside of the slidable frame equal but also to realize parallel sliding by opening and closing operations at any arbitrary portion in the Z-axis direction of the slidable frame, the tension member is preferably formed into a loop that is disposed in the Z-axis direction. Additionally, in order to make overall lengths of the first guide and the second guide correspond to a size in the X-axis direction of openings such as a window frame and a door frame, to which the screen apparatus is installed, it is also preferable that the first guide and the second guide can be individually stored in the inside of the slidable frame, and that the first guide and the second guide pass each other in the inside of the slidable frame. In other words, it is necessary to divide the inside of the slidable frame into a first storage portion for storing the first guide and a second storage portion for storing the second guide.

[0014] In this case, it is necessary that the tension member formed into the loop is configured to be allowed to pass through both of the first storage portion and the second storage portion, and that a direction changing member for changing a direction of the tension member in the Z-axis direction is provided at each of the one end portion in the Z-axis direction and the other end portion in the Z-axis direction of the inside of the slidable frame. Additionally, since the one end portion in the Z-axis direction of the slidable frame corresponds to a gate part through which the first guide is drawn from and stored in the first storage portion, it is necessary for the direction changing member provided at the one end portion in the Z-axis direction of the slidable frame to be disposed in gaps between tip ends in a protruding direction of the needle-like parts of each of the screen retaining members attached to each of the first guide units of the first guide. Accordingly, in order that the direction changing member is disposed as such, it is indispensable to provide a supporting member for supporting the direction changing member at the one end portion in the Z-axis direction of the slidable frame.

[0015] However, the gaps between the tip ends in the protruding direction of the needle-like parts of each of the screen retaining members are very narrow enough to allow the needle-like parts to stab the one end portion in the Z-axis direction of the screen. Additionally, the screen supporting member is required to have a strength to receive a force as a reaction of tension provided the tension member, which is applied to the direction chang-

ing member. Therefore, it is impossible for a size in the Y-axis direction of the supporting member to be reduced less than the gaps between the tip ends in the protruding direction of the needle-like parts of each of the screen retaining members and there is no way to avoid contact between the supporting member and the needle-like parts of each of the screen retaining members. As a result, it is concerned that wear and tear of the supporting member, or deformation, damage, and the like of the needle-like parts of each of the screen retaining members will occur depending on selection of the materials of which the supporting member and the needle-like parts of each of the screen retaining members are made.

[0016] In the light of the above-mentioned problems, the invention provides a screen apparatus that can suppress the contact between the supporting member for supporting the direction changing member which causes the direction of the tension member formed into the loop to change in the Z-axis direction and the needle-like parts of each of the screen retaining members, and can improve the problems of deformation, damage, and the like of the needle-like parts of each of the screen retaining members attached to the first guide together with the wear and tear of the supporting member.

Solution to Problem

[0017] The invention presupposes a screen apparatus includes a screen that can be freely expanded and stored; on a premise that an expansion and storage direction of the screen is defined as an X-axis direction in orthogonal three axes including the X-axis, a Y-axis, and a Z-axis, a pair of frames consisting of a first frame and a second frame, at least one of which is a slidable frame in the X-axis direction, which are longitudinal in the Z-axis direction and hollow, and which are disposed opposite to each other in the X-axis direction; a first guide and a second guide each of which has a free end at an end, and which are drawn from an inside of the slidable frame when the slidable frame is slid to one side in the X-axis direction and are stored in the inside of the slidable frame when the slidable frame is slid to the other side in the X-axis direction; and a tension member that is stored in the inside of the slidable frame and connects the free ends of the first guide and the second guide, wherein one end in the X-axis direction of the screen is fixed to the first frame and the other end in the X-axis direction of the screen is fixed to the second frame, a portion of the first guide, which is drawn from the inside of the slidable frame, is configured to extend linearly in the X-axis direction between one end portions in the Z-axis direction of the pair of the frames, and a portion of the second guide, which is drawn from the inside of the slidable frame, is configured to extend linearly in the X-axis direction between the other end portions in the Z-axis direction of the pair of the frames, wherein the first guide is formed by connecting a plurality of first guide units, each of the first guide units includes a pair of side walls disposed opposite

to each other in the Y-axis direction when the first guide is drawn from the inside of the slidable frame and a bottom wall connecting both of the side walls, one of two adjacent first guide units is pivotally supported by the other, whereby the first guide not only bends to the other side in the Z-axis direction but also maintains linearity in the X-axis direction, and one end portion in the Z-axis direction of the expanded screen is inserted between both of the side walls of each of the first guide units in the portion of the first guide, which is drawn from the inside of the slidable frame, wherein a pair of pins directing outward in the opposite direction of both of the side walls are provided at one end part in the X-axis direction of both of the side walls of each of the first guide units and a pair of openings are opened in the other end parts in the X-axis direction of both of the side walls of each of the first guide units, the two adjacent first guide units are connected by causing each of the pins of the other of the first guide units to loosely fit in each of the openings of one of the first guide units, both of the pins form the pivot, and each of the first guide unit is pivotally movable, wherein a rail part is provided at inner side parts in the opposite direction of both of the side walls of each of the first guide units, the rail part extends along an imaginary line that connects a pivot center of each of the first guide units in a connecting direction, and a supporting piece protruding inward in the opposite direction of both of the side walls is provided at end edge parts of both of the side walls, which are disposed further from the bottom wall than the rail parts in the Z-axis direction, wherein a screen retaining member in which a plurality of needle-like parts aligned at a distance are attached to a longitudinal base that is bendable in a pivotal moving direction of each of the first guide units is detachably attached to an inner side of the opposite direction of both of the side walls of each of the first guide units, in an attached state of each of the screen retaining members, a base is supported between each of the rail parts and each of the supporting pieces of each of the first guide units, and all of the needle-like parts protrude inward in the opposite direction of both of the side walls of each of the first guide units, and wherein when the first guide is drawn to the other side in the X-axis direction accompanying sliding to one side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members stab the one end portion in the Z-axis direction of the screen, which is inserted between both of the side walls of each of the first guide units in the drawn portion of the first guide, and it is impossible for the screen to slip out of the drawn portion of the first guide, and when the first guide is stored in the inside of the slidable frame accompanying sliding to the other side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members slip out of the one end portion in the Z-axis direction of the screen. In the screen apparatus, the tension member is formed into a loop and is disposed in the Z-axis direction. Additionally, in the screen apparatus, the inside of the slidable frame is divided into a first stor-

age portion for storing the first guide at one side in the X-axis direction and a second storage portion for storing the second guide at the other side in the X-axis direction, and both the first storage portion and the second storage portion allow the tension member to pass through. Further, in the screen apparatus, a direction changing member on which the tension member is hung and which causes a direction of the tension member to change in the Z-axis direction is provided in each of insides of one end portion and the other portion in the Z axis-direction of the slidable frame, a supporting member for supporting the direction changing member is provided in the inside of the one end portion of the slidable frame, and the direction changing member is disposed in gaps between tip ends in the protrusion direction of the needle-like parts of each of the screen retaining members attached to each of the first guide units of the first guide at the one end portion in the Z-axis direction of the first storage portion. Furthermore, in the screen apparatus, a pair of relieving pieces extending in the Z-axis direction and opposing to each other in the Y-axis direction are provided with the supporting member, and each of the relieving pieces is configured to come into contact with the needle-like parts of each of the screen retaining members and to bend the needle-like parts so as to move away from the supporting member in the Y-axis direction when the first guide is drawn from and stored in the first storage portion.

[0018] According to the invention, when the first guide is drawn from and stored in the first storage portion, the needle-like parts of each of the screen retaining members can be bent to move away from the supporting member in the Y-axis direction by the pair of relieving pieces provided with the supporting member for supporting the direction changing member which causes the direction of the tension member formed into the loop to change in the Z-axis direction. Therefore, contact between the supporting member and the needle-like parts of the each of the screen retaining members is suppressed, and problems of deformation, damage, and the like of the needle-like parts of the screen retaining members attached to the first guide together with wear and tear of the supporting member are improved.

[0019] In the invention, it is preferable that the supporting member includes a fixing part fixed in the inside of the one end portion in the Z-axis direction of the slidable frame and a supporting part that is disposed at further the one side in the X-axis direction than the fixing part and in which the direction changing member is built, each of the relieving pieces includes a first relieving part protruding from the supporting part to the other side in the Z-axis direction and a second relieving part disposed more outside in an opposite direction of both of the relieving pieces than the first relieving part, the first relieving part has a first slope linearly inclined toward one side of both in the X-axis direction and in the Z-axis direction at a side surface of one side in the X-axis direction, and the second relieving part has a second slope linearly inclined toward the other side in the X-axis direction and one side

in the Z-axis direction at an end surface of one side in the Z-axis direction. According to this, the needle-like parts of each of the screen retaining members can be properly bent depending on movements of the first guide when the first guide is drawn from and stored in the first storage portion and a bent state of the needle-like parts can be caused to be maintained. Therefore, the needle-like parts of each of the screen retaining members move away from the supporting part of the supporting member in the Y-axis direction, and the contact between the supporting member and the needle-like parts of each of the screen retaining members can be effectively suppressed.

[0020] Additionally, in the invention, it is preferable that the supporting member includes a fixing part fixed in the inside of the one end portion in the Z-axis direction of the slidable frame and a supporting part that is disposed at further one side in the X-axis direction than the fixing part and in which the direction changing member is built, each of the relieving pieces includes a first relieving part protruding from the supporting part to the other side in the Z-axis direction and a third relieving part protruding to one side in the Z-axis direction from the supporting part, the first relieving part has a first slope linearly inclined toward one side of both in the X-axis direction and in the Z-axis direction at a side surface of one side in the X-axis direction, and an end face of the one side in the Z-axis direction of the third relieving part is a curved surface convexly curved from the X-axis direction to the Z-axis direction. According to this, the needle-like parts of each of the screen retaining members can be properly bent depending on movements of the first guide when the first guide is drawn from and stored in the first storage portion and a bent state of the needle-like parts can be caused to be maintained. Therefore, the needle-like parts of each of the screen retaining members move away from the supporting part of the supporting member in the Y-axis direction and the contact between the supporting member and the needle-like parts of each of the screen retaining members can be effectively suppressed.

Brief Description of the Drawings

[0021]

FIG. 1 is a partially notched cross section of an embodiment of a screen apparatus of the invention.

FIG. 2 is a main perspective view of a first guide as an embodiment of the screen apparatus shown in FIG. 1.

FIG. 3A is a side view of the first guide shown in FIG. 2 and FIG. 3B is a front view of the first guide shown in FIG. 2.

FIG. 4A is a side view, FIG. 4B is a plan view, FIG. 4C is a bottom view, and FIG. 4D is a front view, of the first guide unit shown in FIGS. 2, 3A and 3B.

FIG. 5A is a side view and FIG. 5B is a front view, of a screen retaining member shown in FIGS. 2, 3A

and 3B.

FIG. 6 is a notched side view of a main portion in a bent state of the screen retaining member when the first guide shown in FIGS. 2, 3A and 3B bends.

FIG. 7 is a perspective view of a lower block constituting a lower portion of a first frame of the screen apparatus shown in FIG. 1.

FIG. 8 is a disassembled perspective view of the lower block shown in the FIG. 7.

FIG. 9 is a sectional view of the lower block shown in FIG. 7.

FIG. 10 is a main plan view that shows a bent state of needle-like parts of each of the screen retaining members by a relieving piece shown in FIG. 7 when the first guide is stored in a first storage portion as shown in FIGS. 2, 3A and 3B.

FIG. 11 is a side view showing another embodiment of the relieving piece of a supporting member shown in FIG. 8.

Description of Embodiments

[0022] Referring to FIG. 1, a screen apparatus SD of the embodiment includes a screen 1 that can be freely expanded and stored, is installed in an opening such as a window frame, door frame, and the like, and the opening is opened and closed in a horizontal direction by the screen 1, for example. In other words, in the screen apparatus SD, an expansion and storage direction is defined as an X-axis direction in orthogonal three axes including the X-axis, a Y-axis, and a Z-axis, the X-axis direction corresponds to the horizontal direction, i.e., a left-right direction in FIG. 1, and the Z-axis direction corresponds to a vertical direction, i.e., an top-bottom direction in FIG. 1. Accordingly, in the following one side in the X-axis direction is defined to be left and the other side in the X-axis direction is defined to be right, and one side in the Z-axis direction is defined to be bottom and the other side in the Z-axis direction is defined to be top.

[0023] The screen apparatus SD includes a first frame 2 that is slidable in the left-right direction of the opening, is longitudinal in the top-bottom direction, and is hollow, and a second frame 3 that is disposed opposite to the first frame 2 in the left-right direction, is fixed to a right end portion of the above-mentioned opening, is longitudinal in the top-bottom direction, and is hollow. A pair of frames consist of the first frame 2 and the second frame 3. A left end of the screen 1 is fixed to the first frame 2 and a right end of the screen 1 is fixed to the second frame 3. Specifically, the left end of the screen 1 is fixed to a right end portion of the first frame 2 and the right end of the screen 1 is fixed to a portion in the top-bottom direction of an outer peripheral part of a roller pipe 31 that is longitudinal in the top-bottom direction, is hollow, and is rotatably stored in an inside of the second frame 3. When a closing operation causes the first frame 2 to slide leftward by a user of the screen apparatus SD, the screen 1 is unwound from the outer peripheral part of the

roller pipe 31 and is expanded in the opening and when the closing operation by the user is stopped, the screen 1 is wound around the outer peripheral part of the roller pipe 31 and is stored in the inside of the second frame 3. At this time, the first frame 2 automatically slides rightward and when a right end of the first frame 2 comes into contact with a left end of the second frame 3, the sliding of the first frame 2 rightward is automatically stopped.

[0024] In order to realize such the automatic storage of the screen 1 in the inside of the second frame 3, a coil spring 31a is built in the inside of the roller pipe 31. When the first frame 2 is slid leftward, the coil spring 31a rotates forward in the inside of the second frame 3 and when the screen 1 is unwound from the outer peripheral part of the roller pipe 31, the coil spring 31a is twisted around a rotation axis of the roller pipe 31, and an elastic force is generated and accumulated. When the user stops a closing operation, the accumulated elastic force is released, the roller pipe 31 reverses in the inside of the second frame 3, and the screen 1 is wound around the outer periphery of the roller pipe 31.

[0025] Additionally, in order to smoothly realize the sliding in left-right direction of the first frame 2, the screen apparatus SD includes an upper rail 4 and a lower rail 5. The upper rail 4 is provided at an upper end portion of the opening and the lower rail 5 is provided at a lower end of the opening. The upper rail 4 is a hollow member of which a section in the top-bottom direction is U-shaped and an upper end portion of the first frame 2 is inserted into an inside of the upper rail 4. The lower rail 5 is a longitudinal and linear member in the left-right direction. Wheels, not shown, are provided at a lower end portion of the first frame 2 and roll on the lower rail 5. Since the sliding in the left-right direction of the first frame 2 is guided by the upper rail 4 and the lower rail 5, the sliding of the first frame 2 in the left-right direction is smoothly realized.

[0026] Further, the screen apparatus SD includes a first guide 6 and a second guide 7 that are drawn from the inside of the first frame 2 when the first frame 2 is slid leftward, and which are stored in the inside of the first frame 2 when the first frame 2 is slid rightward. The first guide 6 and the second guide 7 have free ends 61, 71 at an end, respectively, portions 62, 72 drawn from the inside of the first frame 2 maintain linearity in the left-right direction, and the portion 62 extends in the left-right direction between the lower end portions of the first frame 2 and the second frame 3 as the pair of the frames. Similarly, the portion 72 extends in the left-right direction between the upper end portions of the first frame 2 and second frame 3. Furthermore, the screen apparatus SD includes a tension member 8 that is stored in the inside of the first frame 2 and connects the free ends 61, 71 of the first guide 6 and the second guide 7. The tension member 8 is formed into a non-crossing loop and is disposed in the top-bottom direction. The loop of the tension member 8 may be a crossing loop.

[0027] Referring to FIG. 2, FIG. 3A, FIG. 3B, FIG. 4A, FIG. 4B, FIG. 4C, and FIG. 4D, the first guide 6 is formed

by connecting a plurality of first guide units 63. Each of the first guide units 63 includes a pair of side walls 63a, 63a shown in FIG. 2, which are disposed opposite to each other in the Y-axis direction, and a bottom wall 63b connecting both of the side walls 63a, 63a. In the first guide 6, one of two adjacent first guide units 63, 63 is pivotally supported by the other. The first guide 6 maintains linearity in the left-right direction and upwardly bends due to pivotal support. Additionally, upper left end parts and upper right end parts of both of the side walls 63a, 63a of each of the first guide units 63 correspond to an upper end portion of the portion 62 of the first guide 6 drawn from the inside of the first guide 6. A pair of pins 63c, 63c directing outward in an opposite direction of both of the side walls 63a, 63a are provided with the upper left end parts, and a pair of openings 63d, 63d are opened in the upper right end parts.

[0028] Specifically, a first recessed part 63a₁ recessed inward in the opposite direction of both of the side walls 63a, 63a is formed at a peripheral part of each of the pins 63c in each of the side walls 63a of each of the first guide units 63. A length of each of the pins 63c is equal to a depth of the first recessed part 63a₁, and an outer diameter of each of the pins 63c and an inner diameter of each of the openings 63d are of such a size that each of the pins 63c can be loosely fitted in each of the openings 63d. Additionally, a first notched part 63a₂ is formed by notching a peripheral part of each of the openings 63d with leaving an upper end edge part of each of the side walls 63a and the upper end edge part becomes a protruding piece 63e extending rightward. Further, a hill part 63f rising upwardly is provided with a right and lower end portion of the first recessed part 63a₁. Furthermore, a second recessed part 63a₃ with the same depth as the one of the first recessed part 63a₁ is formed at a portion positioned at a lower end portion of each of the side walls 63a and below the first recessed part 63a₁. Then, the bottom wall 63b is disposed at a position corresponding to a lower end portion of the second recessed part 63a₃ of both of the side walls 63a, 63a in each of the first guide units 63, and has a length from a left end of the second recessed part 63a₃ to a left and lower end of the first notched part 63a₂.

[0029] In the first guide 6, the two adjacent first guide units 63, 63 are connected by inserting the left end parts of both of the side walls 63a, 63a of the other of the first guide units 63 into an inner side of the right end parts of one of the first guide units 63 in the opposite direction of both of the side walls 63a, 63a and by loosely fitting each of the pins 63c of the other of the first guide units 63 in each of the openings 63d of one of the first guide units 63. At this time, both of the pins 63c, 63c form a pivot. The first guide 6 is formed by repetition of such connection of the two adjacent first guide units 63, 63. A pivotal movement range of the two adjacent first guide units 63, 63 is from a position at which the right ends of the lower end parts of both of the side walls 63a, 63a of one of the first guide units 63 and the left ends of the lower end parts

of both of the side walls 63a, 63a of the other of the first guide units 63 contact to a position at which each of the protruding pieces 63e of both of the side walls 63a, 63a of the one of the first guide units 63 and the hill part 63f of each of the first recessed parts 63a₁ that are formed at both of the side walls 63a, 63a of the other of the first guide units 63 contact. The pivotal movement range of each of the first guide units 63 is identical, and due to the pivotal movement in the above-mentioned pivotal movement range of each of the first guide units 63, the first guide 6, as shown in FIG. 1, bends so as to direct toward the upper end portion of the first frame 2 when the first guide 6 is stored in the inside of the first frame 2, and the first guide 6 directs rightward and returns to a linear state when the first guide 6 is drawn from the inside the first frame 2.

[0030] In this connection, when the first guide 6 is drawn from the inside of the first frame 2, each of the second recessed parts 63a₃ that are formed at both of the side walls 63a, 63a of one of the two adjacent first guide units 63, 63, which pivotally moves, is inserted into the inside in the opposite direction of both of the side walls 63a, 63a of the other first guide units 63. Therefore, outer side surfaces in the opposite direction of the lower parts of both of the side walls 63a, 63a of each of the first units 63 are disposed in a same plane in the drawn portion 62 of the first guide 6 from the inside of the first frame 2. Additionally, as above-mentioned, since the length of each of the pins 63c is equal to the depth of the first recessed part 63a₁, an outer side surface in the opposite direction of both of the side walls 63a, 63a of each of the pins 63c and an outer surface in the opposite direction of the upper parts of both of the side walls 63a, 63a are disposed in a same plane.

[0031] Additionally, a rail part 63g is provided at an inner side portion in the opposite direction of each of the side walls 63a, 63a of each of the first guide units 63 and the rail part 63g extends along an imaginary line VL that connects a center of the above-mentioned pivot of each of the first guide units 63. Further, a supporting piece 63h protruding inward in the opposite direction of both of the side walls 63a, 63a is provided at each of the upper end edge parts of both of the side walls 63a, 63a, which is further upward from the bottom wall 63b than the rail part 63g. Each of the supporting pieces 63h is disposed, in the top-bottom direction, opposite to each of the rail parts 63g of each of the side walls 63a at a side that each of the supporting pieces 63h is provided and a storage part 63i that is hollow is formed between each of the supporting pieces 63h and each of the rail parts 63. See FIG. 4D. Specifically, each of the rail parts 63g has a length from the left end of each of the first guide units 63 to the lower left end of the first notched part 63a₂. On the other hand, each of the supporting pieces 63h extends in the left-right direction except the left end part of each of the first guide units 63. Additionally, a front shape of each of the supporting pieces 63h is L-shaped, and each of the supporting pieces 63h consists of a locking part 63h₁

suspending in parallel with respect to each of the side walls 63a and an inclined part 63h₂ extending downhill to a side of the rail part 63g.

[0032] Each of the rail parts 63g functions as a guide when the screen retaining members 9 are attached to and detached from the first guide 6. With reference also to FIGS. 5A and 5B, the screen retaining member 9 consists of a longitudinal base 91 that is bendable in a pivotal moving direction of each of the first guide units 63 of the first guide 6 and longitudinal, and a plurality of needle-like parts 92 that are aligned at a distance and attached to the base 91. The screen retaining member 9 is attached to the inner side in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 by inserting the base 91 into an inside of each of the storage parts 63i of each of the first guide units 63 from one of right and left ends of the first guide 6. Each of the rail parts 63g guides the insertion of the base 91 into the storage part 63i during attachment of the screen retaining member 9. The base 91 is supported between each of the rail parts 63g and each of the supporting pieces 63h and all of the needle-like parts 92 protrude inward in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63. Additionally, the screen retaining member 9 can be detached from the first guide 6, while being guided by each of the rail parts 63g, by drawing the base 91 from the inside of each of the storage parts 63i of each of the first guide units 63 from one of the right and left ends of the first guide 6.

[0033] Specifically, the base 91 is locked by the locking part 63h₁ of the supporting piece 63h of each of the first guide units 63 and all of the needle-like parts 92 are inclined to a side of the bottom wall 63b along the downward slope of the inclined part 63h₂ by the inclined part 63h₂. See FIG. 3B. Due to the inclination of all of the needle-like parts 92, gaps in the Y-axis direction, which are shown in FIG. 2, are formed between tip ends in a protruding direction of the needle-like parts 92 of two of the screen retaining members 9 attached to both of the side walls 63a, 63a of each of the first guide units 63 in the first guide 6.

[0034] Since the bases 91 of the screen retaining members 9 are bendable in the pivotal moving direction of each of the first guide units 63 of the first guide 6, when the first guide 6 shown in FIG. 1 bends upward, as shown in FIG. 6, the screen retaining members 9 also bend in the same direction. Additionally, as above-mentioned, since each of the rail parts 63g extends along the imaginary line VL that connects the center of the above-mentioned pivot of each of the first guide units 63, as shown in FIG. 3A, the base 91 of each of the screen retaining members 9 attached to the inner side in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 is disposed in parallel to the imaginary line VL. The pivotal movement of each of the first guide units 63, i.e., the bending of the first guide 6 is smoothly realized by disposition of the base 91 in parallel to the imaginary line VL. Additionally, since the above-men-

tioned pivot is positioned at the upper end part of the each of the first guide units 63, the above-mentioned pivot is disposed further upward from the lower end of the above-mentioned opening in which the screen apparatus SD is installed. Accordingly, the pivot is less susceptible to dust, sand, mud, and the like which are easily accumulated on the lower end of the above-mentioned opening, and coupled with the smooth bending of the first guide 6, a closing operation of the first frame 2 by the user is performed lightly and stably. Similarly, since the base 91 of the screen retaining member 9 easily returns to the linear state from a bent state, the return of the first guide 6 from the bent state to the linear state when the first guide 6 is drawn from the inside of the first frame 2 can also be smoothly realized. Accordingly, an opening operation of the first frame 2 is also performed lightly and stably.

[0035] Further, a concave part 63j that extends in the same direction as the portion 62 of the first guide 6, which is drawn from the inside of the first frame 2, extends and is recessed inward in the opposite direction of both of the side walls 63a, 63a is provided with both of the side walls 63a, 63a of each of the first guide units 63. A third recessed part 63a₄ that is recessed inward in the opposite direction of both of the side walls 63a, 63a and is similar to the first recessed part 63a₁ and the second recessed part 63a₃ is formed at the left end part of the both of the side walls 63a, 63a, at which the concave part 63j is provided. The third recessed part 63a₄ is positioned between the first recessed part 63a₁ and the second recessed part 63a₃ at each of the side walls 63a. Additionally, a second notched part 63as is formed by cutting an inner surface in the opposite direction of the right end part of both of the side walls 63a, 63a, at which is the concave part 63j is provided. See FIGS. 4B and 4C.

[0036] When the first guide 6 is drawn from the inside of the first frame 2 and each of the first guide units 63 pivotally moves, the second notched part 63as of the first guide unit 63 that pivotally moves overlaps on the third recessed part 63a₄ of the first guide unit 63 that has finished pivotal movement and is disposed adjacent to the first guide unit 63 that pivotally moves. Linearity of the portion 62 of the first guide 6, which is drawn from the inside of the first frame 2, is maintained by overlapping of the second notch 63as on the third recessed part 63a₄ and a contact between the right end of the lower end part of both of the side walls 63a, 63a of the first guide unit 63 that pivotally moves and the left end of both of the side walls 63a, 63a of the first guide unit 63 that has finished pivoting. Additionally, the inner surfaces in the opposite direction of both of the side walls 63a, 63a, at which the concave parts 63j are formed, respectively, are placed flush with each other.

[0037] In this connection, at both of the side walls 63a, 63a of each of the first guide units 63, as shown in FIGS. 3B, 4C and 4D, the inner surface in the opposite direction of the lower end part of each of the second recessed parts 63a₃ is notched and the third notched part 63a₆ is

formed. A notch depth of each of the third notched parts 63a₆ is reduced from the light end to the right end of each of the second recessed parts 63a₃. Additionally, a guided piece 63k continuously protruding inward in the opposite direction of both of the side walls 63a, 63a from the right end of each of the third notched parts 63a₆ is provided. A right end of each of the guided pieces 63k is positioned below the right end of the bottom wall 63b. When the first guide 6 is drawn from the inside of the first frame 2, both of the guided pieces 63k, 63k engage with one side end portion and the other side end portion in the Y-axis direction of the lower rail 5 shown in FIG. 1, respectively, whereby each of the first guide units 63 in the drawn portion 62 of the first guide 6 is suppressed to separate from the lower rail 5. On the other hand, when the first guide 6 is stored in the inside of the first frame 2, each of the third notched parts 63a₆ causes the engagement of the each of the guided pieces 63k with one side end portion and the other side end portion in the Y-axis direction of the lower rail 5 to smoothly release, and separation of the each of the first guide units 63 from the lower rail 5 is facilitated. As a result, the sliding in the left-right direction of the first frame 2 is realized more smoothly.

[0038] Returning to FIG. 1, a right end of the first guide 6 is fixed to the lower end portion of the second frame 3 and becomes a fixed end. Additionally, the free end 61 of the first guide 6 is always stored in the inside of the first frame 2. Specifically, the free end 61 is positioned at an upper end of an adjuster 10 that moves up and down in the top-bottom direction in the inside of the first frame 2. The adjuster 10 is connected to the first guide unit 63 positioned at an upper end when the first guide 6 is stored in the inside of the first guide 6. A weight 101 that is longitudinal in the top-bottom direction and lumpy is attached to the adjuster 10. Gravitational force acting on the weight 101 acts on the portion of the first guide 6, which is stored in the inside of the first frame 2. When the first frame 2 is caused to slide leftward, such the gravitational force assists the first guide 6 to be smoothly drawn rightward from the inside of the first frame 2 against the elastic force of the coil spring 31a built in the roller pipe 31 and provides the closing operation by the user a comfortable and stable feeling. Additionally, when the first frame 2 is slid rightward and the screen 1 is stored in the inside of the second frame 3, the gravitational force acting on the weight 101 provides a suitable resistance to the storage of the first guide 6 in the inside of the first frame 2. Rapid winding of the screen 1 around the outer periphery of the roller pipe 31 due to release of the elastic force accumulated in the coil spring 31a is suppressed by the resistance.

[0039] A curved protrusion 11 curved by a prescribed curvature is provided with a pair of inner side surfaces, not shown, opposite to each other in the Y-axis direction shown in FIG. 1. The curved protrusion 11 guides the storage of the first guide 6 in the inside of the first frame 2 and the withdrawal of the first guide 6 from the in the

inside of the first frame 2 due to insertion of the curved protrusion 11 into the concave part 63j of each of the first guide units 63. In other words, the curved protrusion 11 is curved by the prescribed curvature that can bend the first guide 6 so as to direct upward and return the first guide 6 rightward in the inside of the first frame 2. Accordingly, a smoother storage of the first guide 6 in the inside of the first frame 2 and a smoother withdrawal of the first guide 6 from the first frame 2 are realized.

[0040] In the screen apparatus SD, when the first guide 6 is drawn from the inside of the lower portion of the first frame 2 rightward accompanying the leftward sliding of the first frame 2, a lower end portion of the screen 1 is inserted between both of the side walls 63a, 63a of each of the first guide units 63 in the drawn portion 62 of the first guide 6. Specifically, the lower end portion of the screen 1 is inserted into the above-mentioned gaps between the tip ends in the protruding direction of the needle-like parts 92 shown in FIGS. 2, 3A and 3B of the two screen retaining members 9 attached to both of the side walls 63a, 63a of each of the first guide units 63. At this time, each of the needle-like parts 92 of the screen retaining members 9 stabs the lower end portion of the screen 1 and it becomes impossible for the screen 1 to slip out of the drawn portion 62 of the first guide 6. Additionally, when the first guide 6 is stored in the inside of the first frame 2 accompanying the rightward sliding of the first frame 2, the needle-like parts 92 of each of the screen retaining members 9 slip out of the lower end portion of the screen 1, which the needle-like parts 92 have stabbed. As above-mentioned, in the screen apparatus SD, since the screen retaining members 9 are detachably attached to the inner sides in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 of the first guide 6, multiple kinds of the screen retaining members 9 which are made by attaching a plurality of the needle-like parts 92 corresponding to the kind of the screen 1 to the base 91 can be prepared in advance. Further, an appropriate screen retaining member 9 selected from the multiple species can be attached to both of the side walls 63a, 63a of each of the first guide units 63 of the first guide 6, whereby damage to the lower end portion of the screen 1 can be suppressed even by repetition of expansion and storage of the screen 1. Additionally, it is not necessary for the first guide unit 63 to be made of each kind of the screens 1 and the first guide 6 can be made of only one kind of the first guide unit 63.

[0041] In this connection, an integrally molded product made of a hard resin can be adopted to each of the first guide units 63. A cloth and a net knitted with fibers made of a resin and the like can be adopted to the screen 1 under consideration of weight reduction. A soft resin, a light metal and the like can be adopted to a material for the base 91 of the screen retaining member 9. The needle-like parts 92 are made of an appropriate material to the kind of the screen 1. Additionally, a size of each of the needle-like parts 92 and a distance between the nee-

dle-like parts 92 can be appropriately set corresponding to the kind of the screen 1. For example, in a case where the screen 1 is a knitted fabric or a net, the size of each of the needle-like parts 92 can be a size which each of the needle-like parts 92 can enter a stitch or a mesh, and the distance between each of the needle-like parts 92 can be equal to that between the stitches or the meshes. Further, the curved protrusion 11 can be made of a material such that each of the first guide units 63 is not easily worn out even by repetitive insertion of the curved protrusion 11 into the concave part 63j of each of the first guide units 63.

[0042] Furthermore, the second guide 7 that is provided with the screen apparatus SD can be adopted to a conventional one. Similar to the first guide 6, the conventional guide is also formed by connecting of a plurality of second guide units 73. Each of the second guide units 73 also includes a pair of side walls, which are disposed opposite to each other in the Y-axis direction, when the second guide 7 is drawn from the inside of the first frame 2, and a bottom wall connecting the side walls. Additionally, one of two adjacent second guide units 73 is pivotally supported by the other of the two adjacent second guide units 73. The second guide 7 may be any of which an upper end portion of the expanded screen 1 is inserted between both of the side walls of each of the second guide units 73 in a drawn portion 72 of the inside of the first frame 2. Similar to the first guide 6, a right end of the second guide 7 is fixed to the second frame 3 and becomes a fixed end.

[0043] In the screen apparatus SD, each of the first guide 6 and the second guide 7 is stored in a separate region of the inside of the first frame 2. In other words, a first guiding piece 21 extending in the longitudinal direction of the first frame 2 and protruding inward in the opposite direction of both of the inner side surfaces is provided with each of a pair of inner side surfaces except both of the upper and lower end portions of the first frame 2, which are opposite in the Y-axis direction of the first frame 2. The inside of the first frame 2 is divided into a first storage portion 22 for storing the first guide 6 and a second storage portion 23 for storing the second guide 7 by both of the first guiding pieces 21. The first storage portion 22 is positioned at a left side that is one side in the X-axis direction of the inside of the first frame 2 and the second storage portion 23 is positioned at a right side that is the other side in the X-axis direction of the inside of the first frame 2. The first guide 6 and the second guide 7 that are stored in the inside of the first frame 2 do not collide with each other but pass each other in the inside of the first frame 2 due to the division of the storage regions of the first guide 6 and the second guide 7 in the inside of first frame 2 into the first storage portion 22 and the second storage portion 23. Therefore, entire length of each of the first guide 6 and the second guide 7 can correspond to a size in the left-right direction of the opening in which the screen apparatus SD is installed. Additionally, the needle-like parts 92 of the screen retaining

members 9 attached to the inner sides in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 of the first guide 6 are not damaged by the second guide 7 and structural constraints are not imposed on the second guide unit 73 forming the second guide 7. Further, in each of the first guide units 63 of the first guide 6, in order to make it less susceptible to dust, sand, mud, and the like that are easily accumulated on the lower end of the above-mentioned opening in which the screen apparatus SD is installed, the bottom wall 63b in the drawn portion 62 of the first storage portion 22 is positioned away from the lower rail 5. Therefore, a size in the top-bottom direction of each of the first guide units 63 of the first guide 6 becomes relatively large. Accordingly, the curvature of bending of the first guide 6 when the first guide 6 is stored in and drawn from the first storage portion 22 can become relatively large due to the first storage portion 22 that is positioned at the left side in the inside of the first frame 2, and the storage of the first guide 6 in the first storage portion 22 and the withdrawal of the first guide 6 from the first storage portion 22 are performed more smoothly.

[0044] In this connection, protruding ends of both of the first guiding pieces 21, 21 are disposed away from each other in the Y-axis direction and the tension member 8 is possible to enter both the first storage portion 22 and the second storage portion 23. Additionally, both of the first guiding pieces 21, 21 guide not only up and down movements of the adjuster 10 of the first guide 6 but also up and down movements of the guided member 12 that is connected to the second guide unit 73 positioned at a lower end portion of the second guide 7 when the second guide 7 is stored in the second storage portion 23 and forms the free end 71 of the second guide 7. The free end 71 of the second guide 2 is positioned at a lower end of the guided member 12.

[0045] Thus, in a case where the first guide 6 and the second guide 7 are configured to be stored in the first storage portion 22 and the second storage portion 23 that are separate regions in the inside of the first frame 2, respectively, an aspect size, i.e., a size in the left-right direction, of the first frame 2 becomes relatively large. Taking into consideration of the aspect size of the first frame 2, it is preferable that the size in the top-bottom direction of both of the side walls of each of the second guide units 73 in the drawn portion 72 of the second storage portion 23 of the first frame 2 is shorter than that in the top-bottom direction of both of the side walls 63a, 63a of each of the first guide units 63 in the drawn portion 62 of the first storage portion 22 of the first frame 2. In a case where it is difficult for the screen retaining member 9 to be attached to the first guide 6 is attached to the second guide 7, a screen retaining member 13 that is longitudinal in the left-right direction is attached to each of a pair of inner side surfaces opposing to each other in the Y-axis direction of the upper rail 4 through a supporting piece and the like. The similar constitution to that of the screen retaining member 9 is adopted to the screen

retaining member 13, for example. In this case, each of the needle-like parts of the screen retaining member 13 stabs the upper end portion of the expanded screen 1 and slipping-out of the expanded screen 1 from the upper rail 4 due to receiving of an external force such as a wind pressure can be suppressed. Additionally, damage to the upper end portion of the screen 1 can be suppressed even by repeating the expansion and storage of the screen 1.

[0046] In the screen apparatus SD, a bending guide 14 having a curved surface 141 curved by a prescribed curvature is provided at the upper end portion of the second storage portion 23 of the first frame 2. The curved surface 141 of the bending guide 14 is capable of coming into contact with the bottom wall of each of the second guide units 73 forming the second guide 7. Due to the contact between the curved surface 141 and the bottom wall of each of the second guide units 73, the bending guide 14 causes each of the second guide units 73 to pivotally move and bends the second guide 7 downward, and causes the second guide 7 to return in the left-right direction. Therefore, the storage of the second guide 7 in the second storage portion 23 and the withdrawal of the second guide 7 from the second storage portion 23 accompanying the sliding of the first frame 2 in the left-right direction are smoothly realized. The prescribed curvature of the curved surface 141 can be appropriately set under consideration of such the bending and returning of the second guide 7.

[0047] Further, a direction changing member 15 such as a pulley is provided at each of the upper and lower end portions of the first storage portion 22 of the first frame 2 in the screen apparatus SD. The tension member 8 is hung on each of the direction changing members 15. Each of the direction changing members 15 causes a direction of the tension member 8 to change in the Z-axis direction and provides a prescribed tension to the tension member 8.

[0048] Referring to FIGS. 7, 8 and 9, the lower end portion of the first frame 2 is formed by a lower block LB that is separable from and connectable to the other portion of the first frame 2. The lower block LB is a hollow member opened upward, downward and rightward. An upper end opening LBa is disposed at a portion corresponding to a lower end opening of the first storage portion 22 shown in FIG. 1. Additionally, a supporting member 16 for disposing the direction changing member 15 in the vicinity of the upper end opening LBa and supporting the direction changing member 15 is provided with the lower block LB. In other words, the direction changing member 15 is disposed at the lower end portion of the first storage portion 22 through the supporting member 16.

[0049] Further, the lower block LB is divided into the first part LB1 and the second part LB2 at a center in the Y-axis direction. The curved protrusion 11 is integrally formed at inner surfaces of the first part LB1 and an inner surface of the second part LB2, which oppose to each

other when the lower block LB is assembled. Additionally, the curved protrusions 11, 11 are positioned at a portion depending on movements of the concave part 63j of each of the first guide units 63 when the first guide 6 is stored in and drawn from the first storage portion 22 as shown in FIG. 1.

[0050] The supporting member 16 includes, at a left-half portion, a supporting part 16a in which the direction changing member 15 is built together with a rotational shaft 15a of the direction changing member 15. Two insertion holes 16a₁ for hanging the tension member 8 on the direction changing member 15 and changing the direction of the tension member 8 in the top-bottom direction pierce the supporting part 16a in the top-bottom direction. Additionally, the supporting member 16 includes a fixing part 16b to the lower block LB at the right-half portion. A pair of wedge protrusions 16b₁, 16b₁ opposing to each other in the Y-axis direction are provided with the fixing part 16b in order to fix the supporting member 16 to the first part LB1 and the second part LB2. The supporting member 16 is inserted into an inside of the lower block LB from below and fixed to the lower block LB. Therefore, a second guiding piece 16b₂ for guiding insertion of the supporting member 16 into the lower block LB is provided at a right end of the fixing part 16b. The second guiding piece 16b₂ protrudes below a lower end of the fixing part 16b. Further, a pair of relieving pieces 16a₂, 16a₂ extending in the top-bottom direction and opposing to each other in the Y-axis direction are provided with each of side surfaces in the Y-axis direction of the supporting member 16. Each of the relieving pieces 16a₂ includes a first relieving part 16a₂₁ protruding above an upper end of the supporting part 16a and a second relieving part 16a₂₂ disposed further outside in an opposite direction of both of the relieving pieces 16a₂, 16a₂ than the first relieving part 16a₂₁. A lower end of the second relieving part 16a₂₂ is positioned up to a lower end of the supporting part 16a.

[0051] A dovetail groove LB3 for fixing the supporting member 16 is formed at a portion of each of the first part LB1 and the second part LB2 of the lower block LB, which corresponds to the wedge protrusion 16b₁ of the fixing part 16b of the supporting member 16, and a guiding groove LB4 is provided at a right end portion of the first part LB1. When the supporting member 16 is fixed to the lower block LB, the first part LB1 and the second part LB2 are overlapped so that the curved protrusions 11, 11 face to each other in the inside of the lower block LB, and the supporting member 16 is inserted into the inside of the lower block LB from below. At this time, the first part LB1 and the second part LB2 are aligned so that the second guiding piece 16b₂ of the fixing part 16b of the supporting member 16 can be inserted into the guiding groove LB4 and the supporting member 16 is pushed up. The wedge protrusion 16b₁ of the fixing part 16b is inserted into the dovetail groove LB3 from below and is finally fitted to the dovetail groove LB3 as the supporting member 16 is pushed up. As a result, the supporting

member 16 is fixed in the inside of the lower block LB. In a fixed state of the supporting member 16, the direction changing member 15 built in the supporting part 16a of the supporting member 16 is disposed, in the inside of the lower end portion of the lower block LB, at a portion corresponding to the gaps of the tip ends in the protrusion direction of the needle-like parts 92 of each of the screen retaining members 9 attached to the inside in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 of the first guide 63.

[0052] On the other hand, the supporting part 16a of the supporting member 16 is disposed between both of the side walls 63a, 63a of each of the first guide units 63 of the first guide 6. Then, as above-mentioned, the pair of the relieving pieces 16a₂, 16a₂ are provided with the supporting part 16a. Each of the relieving pieces 16a₂ comes into contact with the needle-like parts 92 of each of the screen retaining members 9 when the first guide 6 is drawn from and stored in the first storage portion 22. Therefore, as shown in FIG. 10, when the first guide 6 is drawn from and stored in the first storage portion 22, each of the relieving pieces 16a₂ causes the needle-like parts 92 of each of the screen retaining members 9 to bend to the inner side in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 and causes the needle-like parts 92 of each of the screen retaining members 9 to move away from the supporting part 16a in the Y-axis direction. Accordingly, contact between the supporting member 16 and the needle-like parts 92 of each of the screen retaining members 9 is suppressed and problems such as deformation, damage, and the like of the needle-like parts 92 together with wear and tear of the supporting member 16 are solved.

[0053] Specifically, in each of the relieving pieces 16a₂ shown in FIGS. 7, 8 and 9, the first relieving part 16a₂₁ has a first slope 16a_{21a} linearly inclined leftward and downward at a left side surface and the second relieving part 16a₂₂ has a second slope 16a_{22a} of which a lower end surface is inclined rightward and downward. An upper end part of the second slope 16a_{22a} is chamfered so as to be a convex curved surface. When the first guide 6 is drawn from the first storage portion 22, the first guide 6 moves linearly in the first storage portion 22 downward. Therefore, in order to cause the needle-like parts 92 of each of the screen retaining members 9 to bend smoothly, the first relieving part 16a₂₁ having the first slope 16a_{21a} at the left side surface is effective. The first slope 16a_{21a} comes into contact with middle portions of the needle-like parts 92 of each of the screen retaining members 9, which are positioned from a side of the base 91 to a side of the tip ends in the protruding direction, and causes the needle-like parts 92 to bend to a side of the inner surfaces in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63. Thereafter, the first slope 16a_{21a} keeps in contact with a portion up to the side of the tip ends in the protruding direction of the bent needle-like parts 92 and causes the needle-like parts 92 to maintain a bent state. Additionally, since

the slide guide 6 bends from right bottom to left top when the slide guide 6 is stored in the first storage portion 22, the second relieving part 16a₂₂ of which a lower end surface is the second slope 16a_{22a} is effective to cause the needle-like parts 92 of each of the screen retaining members 9 to bend smoothly. The second slope 16a_{22a} comes into contact with portions of the needle-like parts 92 of each of the screen retaining members 9, which are positioned near the base 91, and causes the needle-like parts 92 to bend the side of the inner surfaces in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63. Thereafter, the second slope 16a_{22a} keeps in contact with the middle portions up to the side of the tip ends in the opposite direction of the bent needle-like parts 92 and causes the needle-like parts 92 to maintain a bent state. Accordingly, depending on the movements of the first guide 6 when the first guide 6 is drawn from and stored in the first storage portion 22, each of the relieving pieces 16a₂ shown in FIGS. 7, 8 and 9 can not only cause the needle-like parts 92 of each of the screen retaining members 9 to properly bend to the side of the inner surfaces in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 but can also cause the needle-like parts 92 to maintain the bent states. Therefore, the needle-like parts 92 of each of the screen retaining members 9 move away from the supporting part 16a in the Y-axis direction and the contact between the supporting member 16 and the needle-like parts 92 of each of the screen retaining members 9 can be effectively suppressed.

[0054] In this connection, each of the relieving pieces 16a₂ is not restricted to the embodiment shown in FIGS. 7, 8 and 9 and, as shown in FIG. 11, a member that includes the first relieving part 16a₂₁ and a third relieving part 16a₂₃ downwardly protruding from the supporting part 16a, of which a lower end surface is a curved surface 16a_{23a} convexly curved rightward and downward is applicable to each of the relieving pieces 16a₂. The first relieving part 16a₂₁ and the third relieving part 16a₂₃ are disposed in a same vertical plane in each of the relieving pieces 16a₂ shown in FIG. 11. The curved surface 16a_{23a} of the third relieving part 16a₂₃ of each of the relieving pieces 16a₂ functions like the first slope 16a_{21a} of the first relieving part 16a₂₁ of each of the relieving pieces 16a₂ shown in FIGS. 7, 8 and 9. Namely, when the first guide 6 is stored in the first storage portion 22, the curved surface 16a_{23a} comes into contact with the middle portions of the needle-like parts 92 of each of the screen retaining members 9, which are disposed from the side of the base 91 to the side of the tip ends in the protruding direction, and causes the needle-like parts 92 to bend toward the side of the inner surfaces in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63. Thereafter, the curved surface 16a_{23a} keeps in contact with the portion up to the side of the tip ends in the protruding direction of the bent needle-like parts 92 and causes the needle-like parts 92 to maintain the bent state. Accordingly, when the first guide 6 is

drawn from and stored in the first storage portion 22, the relieving piece 16a₂ shown in FIG. 10, like the each of the relieving pieces 16a₂ shown in FIGS. 7, 8 and 9 can not only cause the needle-like parts 92 of each of the screen retaining members 9 to bend toward the side of the inner surfaces in the opposite direction of both of the side walls 63a, 63a of each of the first guide units 63 but can also cause the needle-like parts 92 to maintain the bent state. Therefore, the needle-like parts 92 of each of the screen retaining members 9 move away from the supporting part 16a in the Y-axis direction and contact between the supporting member 16 and the needle-like parts 92 of each of the screen retaining members 9 can be effectively suppressed.

[0055] Additionally, like the second relieving part 16a₂₂ of each of the relieving pieces 16a₂ shown in FIGS. 7, 8 and 9, the third relieving part 16a₂₃ of each of the relieving pieces 16a₂ shown in FIG. 11 may be disposed further outside in the opposite direction of both of the relieving pieces 16a₂, 16a₂ than the first relieving part 16a₂₁.

[0056] Incidentally, the tension member 8 shown in FIG. 1 is, for example, a string. The tension member 8 is hung on both of the direction changing members 15, 15, one of which is disposed at the lower end portion of the first storage portion 22 and the other of which is disposed at the upper end portion of the first storage portion 22, and is passed from the first storage portion 22 to the second storage portion 23 through both of the first guiding pieces 21, 21. A ball knot is formed at an end portion of the tension member 8. The ball knot is inserted into a not-shown slit which is formed at a lower end part of the guided member 12 forming the free end 71 of the second guide 7 and downwardly extends, is caught in a lower end edge part of the guided member 12, and is fixed to the guided member 12. Additionally, a portion of the other end side of the tension member 8 is hung on a part of a right end side of a screw head from above and upwardly directs again and another ball knot is formed at an upper end part of the portion of the other end side of the tension member 8. Another ball knot is inserted into a not-shown slit which is formed at an upper end part of the guided member 12 forming the free end 71 of the second guide 7 and downwardly extends, is caught in an upper end edge part of the guided member 12, and is fixed to the guided member 12. The screw is passed through an inside of a slot that is formed in the guided member 12 and extends in the top-bottom direction. A tightening position in the top-bottom direction of the screw with respect to the guided member 12 is adjusted and a prescribed tension is applied to the tension member 8. Further, a portion of the tension member 8, which is positioned at the first storage portion 22 between both of the direction changing members 15, 15, is pressed leftward and is fixed to the upper end part of the adjuster 10 forming the free end 61 of the first guide 6 by the screw. Thus, the tension member 8 connects the free end 61 of the first guide 6 and the free end 71 of the second guide 7, and forms a loop disposed in the top-bottom direction. A stored length in

the first storage portion 22 and a drawn length of the first storage portion 22 of the first guide 6 become equal to a stored length in the second storage portion 23 and a drawn length of the second storage portion 23 of the second guide 7 due to the loop formed by the tension member 8. As a result, a parallel sliding of the first frame 2 with respect to the second frame 3 can be certainly realized. Additionally, the parallel sliding of the first frame 2 is realized by the closing operation of the user at an arbitrary portion in the top-bottom direction of the first frame 2. Further, the parallel sliding of the first frame 2 is also realized during the opening operation due to the elastic force of the coil spring 31a. The prescribed tension applied to the tension member 8 is appropriately set under consideration of the above-mentioned sliding of the first frame 2.

[0057] Though the invention is described regarding the above-mentioned embodiment, the invention is not restricted to the above-mentioned embodiment. For example, in addition to such the automatic storage manner using the elastic force of the coil spring 31a as in the above-mentioned embodiment, an automatic opening and closing manner using a torque when a motor rotates for the expansion and storage of the screen 1 and an opening and closing manner manually performing both of the expansion and storage of the screen 1 may be applicable to the screen apparatus SD. Additionally, a foldable screen in which a plurality of pleats are formed can be adopted to the screen 1. Further, in the case of the screen apparatus SD of the manual opening and closing manner, the second frame 3 is not fixed to the above-mentioned opening and is made slidable in the left-right direction like the first frame 2, whereby a screen apparatus SD can be a double-opening manner. Furthermore, the Z-axis direction is not limited to the vertical direction but may be an orthogonal direction with respect to the X-axis direction. For example, the screen apparatus SD can be installed in an inclined opening that is inclined with respect to the vertical plane.

Explanation of symbols

[0058]

SD	Screen apparatus
1	Screen
2	First frame
22	First storage portion
23	Second storage portion
3	Second frame
6	First guide
61	Free end of first guide 6
62	Drawn portion of first guide 6 from inside of first frame 2
63	First guide unit
63a	Side wall
63b	Bottom wall
63c	Pin

63d	Opening	
63g	Rail part	
63h	Supporting piece	
7	Second guide	
71	Free end of second guide 7	5
8	Tension member	
9	Screen retaining member	
91	Base	
92	Needle-like parts	
VL	Imaginary line	10
15	Direction changing member	
16	Supporting member	
16a	Supporting part	
16b	Fixing part	
16a ₂	Relieving piece	15
16a ₂₁	First relieving part	
16a _{21a}	First slope	
16a ₂₂	Second relieving part	
16a _{22a}	Second slope	
16a ₂₃	Third relieving part	20
16a _{23a}	Curved surface	

Claims

1. a screen apparatus, comprising,
- a screen that can be freely expanded and stored;
 - on a premise that an expansion and storage direction of the screen is defined as an X-axis direction in orthogonal three axes comprising the X-axis, a Y-axis, and a Z-axis, a pair of frames consisting of a first frame and a second frame, at least one of which is a slidable frame in the X-axis direction, which are longitudinal in the Z-axis direction and hollow, and which are disposed opposite to each other in the X-axis direction;
 - a first guide and a second guide each of which has a free end at an end, and which are drawn from an inside of the slidable frame when the slidable frame is slid to one side in the X-axis direction and are stored in the inside of the slidable frame when the slidable frame is slid to the other side in the X-axis direction; and
 - a tension member that is stored in the inside of the slidable frame and connects the free ends of the first guide and the second guide,
- wherein one end in the X-axis direction of the screen is fixed to the first frame and the other end in the X-axis direction of the screen is fixed to the second frame, a portion of the first guide, which is drawn from the inside of the slidable frame, is configured to extend linearly in the X-axis direction between one end portions in the Z-axis direction of the pair of the frames, and a portion of the second guide, which is drawn from

the inside of the slidable frame, is configured to extend linearly in the X-axis direction between the other end portions in the Z-axis direction of the pair of the frames,

wherein the first guide is formed by connecting a plurality of first guide units, each of the first guide units includes a pair of side walls disposed opposite to each other in the Y-axis direction when the first guide is drawn from the inside of the slidable frame and a bottom wall connecting both of the side walls, one of two adjacent first guide units is pivotally supported by the other, whereby the first guide not only bends to the other side in the Z-axis direction but also maintains linearity in the X-axis direction, and one end portion in the Z-axis direction of the expanded screen is inserted between both of the side walls of each of the first guide units in the portion of the first guide, which is drawn from the inside of the slidable frame,

wherein a pair of pins directing outward in the opposite direction of both of the side walls are provided at one end part in the X-axis direction of both of the side walls of each of the first guide units and a pair of openings are opened in the other end parts in the X-axis direction of both of the side walls of each of the first guide units, the two adjacent first guide units are connected by causing each of the pins of the other of the first guide units to loosely fit in each of the openings of one of the first guide units, both of the pins form the pivot, and each of the first guide unit is pivotally movable,

wherein a rail part is provided at inner side parts in the opposite direction of both of the side walls of each of the first guide units, the rail part extends along an imaginary line that connects a pivot center of each of the first guide units in a connecting direction, and a supporting piece protruding inward in the opposite direction of both of the side walls is provided at end edge parts of both of the side walls, which are disposed further from the bottom wall than the rail parts in the Z-axis direction,

wherein a screen retaining member in which a plurality of needle-like parts aligned at a distance are attached to a longitudinal base that is bendable in a pivotal moving direction of each of the first guide units is detachably attached to an inner side of the opposite direction of both of the side walls of each of the first guide units, in an attached state of each of the screen retaining members, a base is supported between each of the rail parts and each of the supporting pieces of each of the first guide units, and all of the needle-like parts protrude inward in the opposite direction of both of the side walls of each of the first guide units, and

wherein when the first guide is drawn to the other side in the X-axis direction accompanying sliding to one side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members stab the one end portion in the Z-axis direction of the screen, which is inserted between both of the side walls of each of the first guide units in the drawn portion of the first guide, and it is impossible for the screen to slip out of the drawn portion of the first guide, and when the first guide is stored in the inside of the slidable frame accompanying sliding to the other side in the X-axis direction of the slidable frame, the needle-like parts of each of the screen retaining members slip out of the one end portion in the Z-axis direction of the screen, **characterized in that:**

the tension member is formed into a loop and is disposed in the Z-axis direction, the inside of the slidable frame is divided into a first storage portion for storing the first guide at one side in the X-axis direction and a second storage portion for storing the second guide at the other side in the X-axis direction, and both the first storage portion and the second storage portion allow the tension member to pass through, a direction changing member on which the tension member is hung and which causes a direction of the tension member to change in the Z-axis direction is provided in each of insides of one end portion and the other portion in the Z axis-direction of the slidable frame, a supporting member for supporting the direction changing member is provided in the inside of the one end portion of the slidable frame, and the direction changing member is disposed in gaps between tip ends in the protrusion direction of the needle-like parts of each of the screen retaining members attached to each of the first guide units of the first guide at the one end portion in the Z-axis direction of the first storage portion, and a pair of relieving pieces extending in the Z-axis direction and opposing to each other in the Y-axis direction are provided with the supporting member, and each of the relieving pieces is configured to come into contact with the needle-like parts of each of the screen retaining members and to bend the needle-like parts so as to move away from the supporting member in the Y-axis direction when the first guide is drawn from and stored in the first storage portion.

2. The screen apparatus as claimed in claim 1, wherein

the supporting member includes a fixing part fixed in the inside of the one end portion in the Z-axis direction of the slidable frame and a supporting part that is disposed at further the one side in the X-axis direction than the fixing part and in which the direction changing member is built, each of the relieving pieces includes a first relieving part protruding from the supporting part to the other side in the Z-axis direction and a second relieving part disposed more outside in an opposite direction of both of the relieving pieces than the first relieving part, the first relieving part has a first slope linearly inclined toward one side of both in the X-axis direction and in the Z-axis direction at a side surface of one side in the X-axis direction, and the second relieving part has a second slope linearly inclined toward the other side in the X-axis direction and one side in the Z-axis direction at an end surface of one side in the Z-axis direction.

3. The screen apparatus as claimed in claim 1, wherein the supporting member includes a fixing part fixed in the inside of the one end portion in the Z-axis direction of the slidable frame and a supporting part that is disposed at further one side in the X-axis direction than the fixing part and in which the direction changing member is built, each of the relieving pieces includes a first relieving part protruding from the supporting part to the other side in the Z-axis direction and a third relieving part protruding to one side in the Z-axis direction from the supporting part, the first relieving part has a first slope linearly inclined toward one side of both in the X-axis direction and in the Z-axis direction at a side surface of one side in the X-axis direction, and an end face of the one side in the Z-axis direction of the third relieving part is a curved surface convexly curved from the X-axis direction to the Z-axis direction.

FIG.1

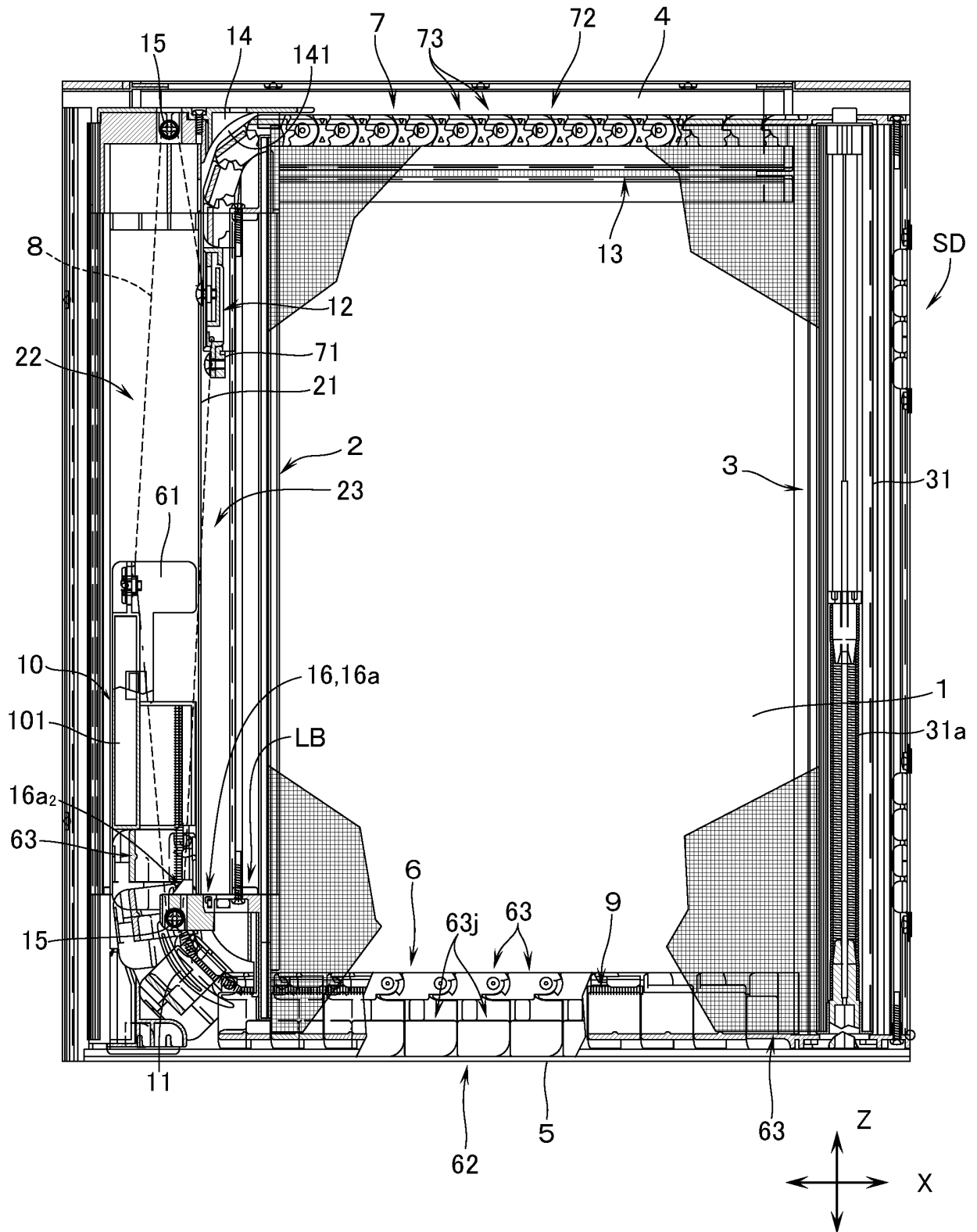


FIG.2

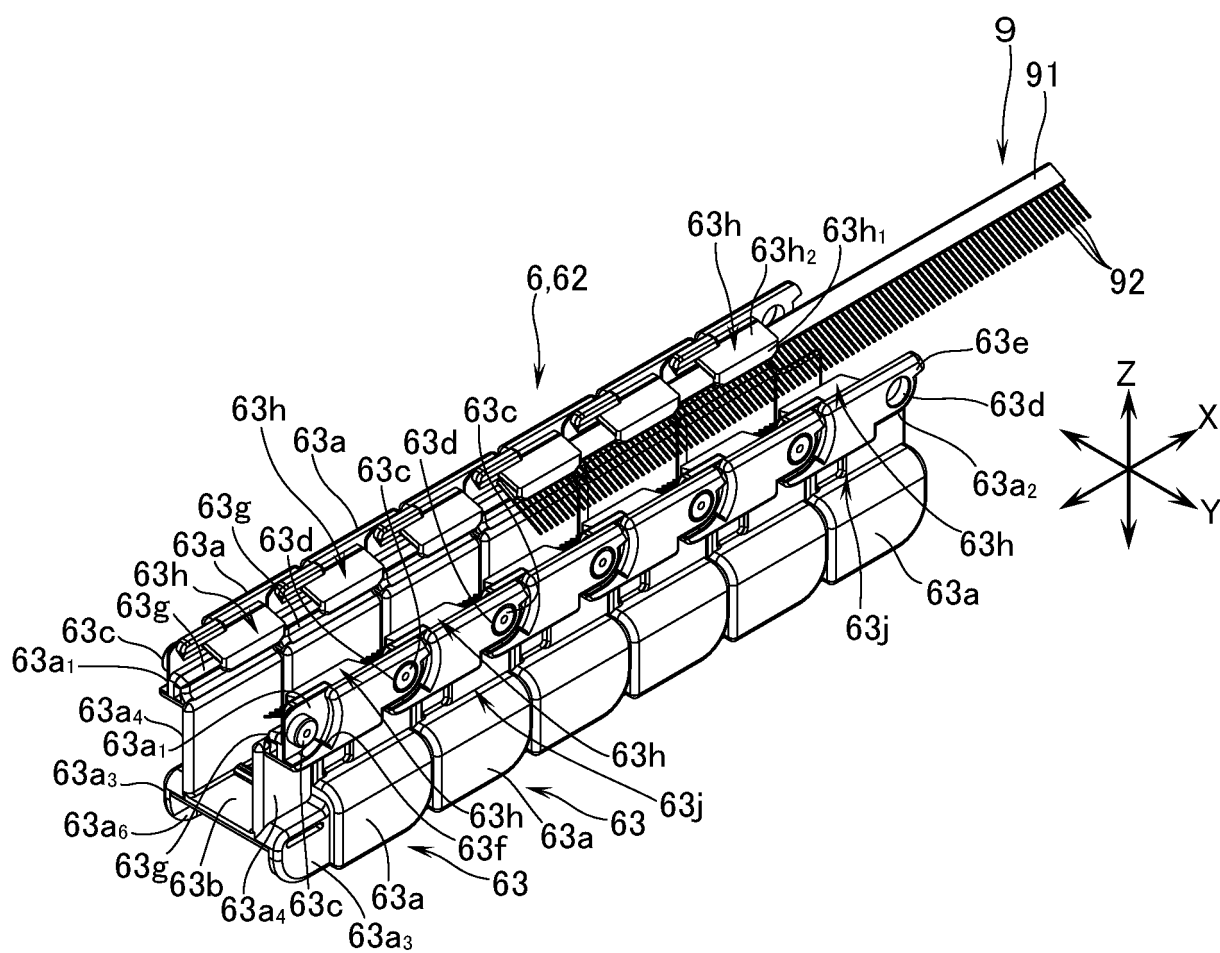


FIG.3A

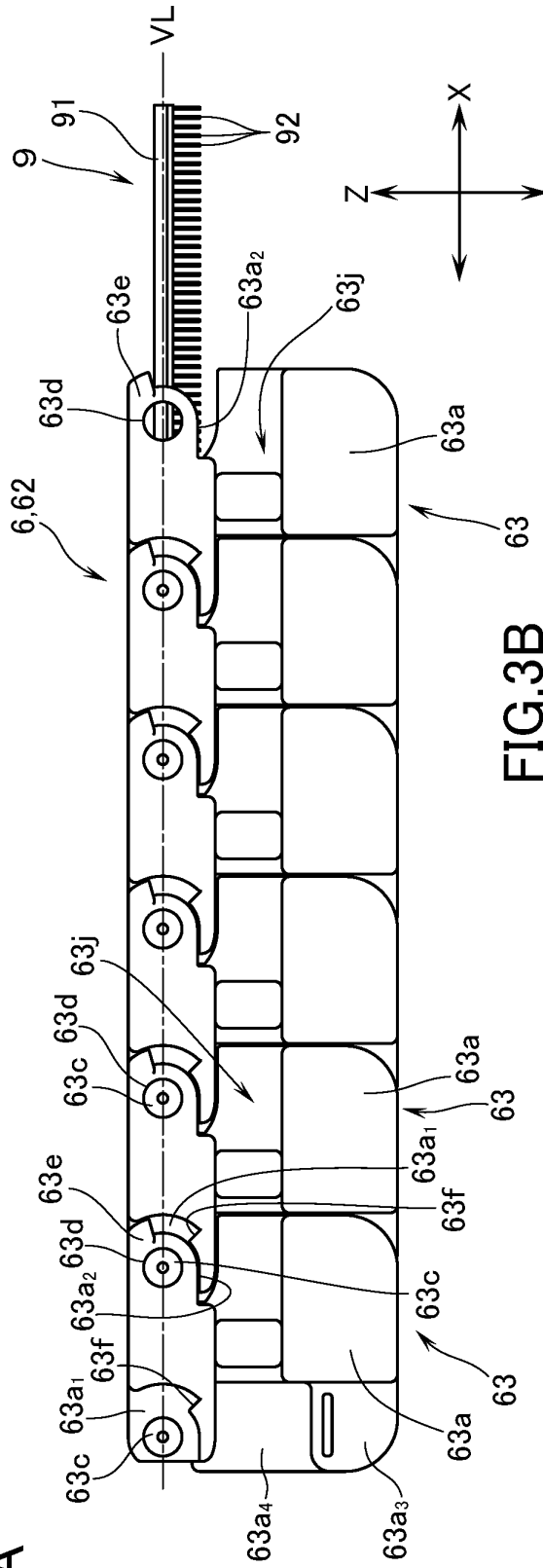


FIG.3B

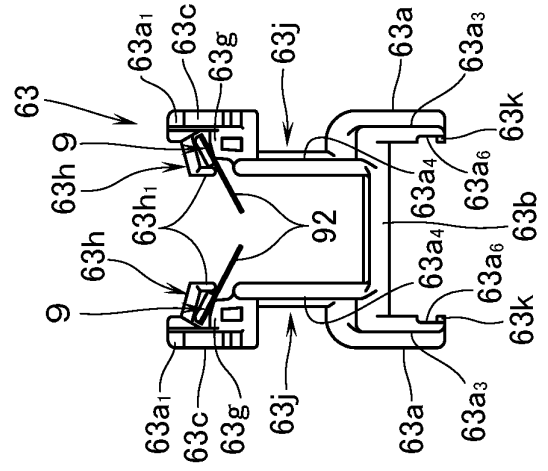


FIG.4A

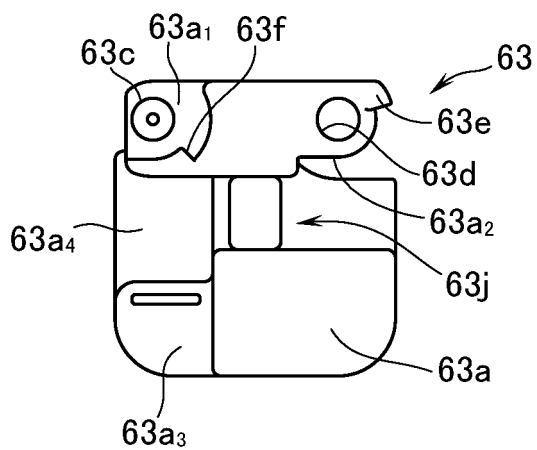


FIG.4B

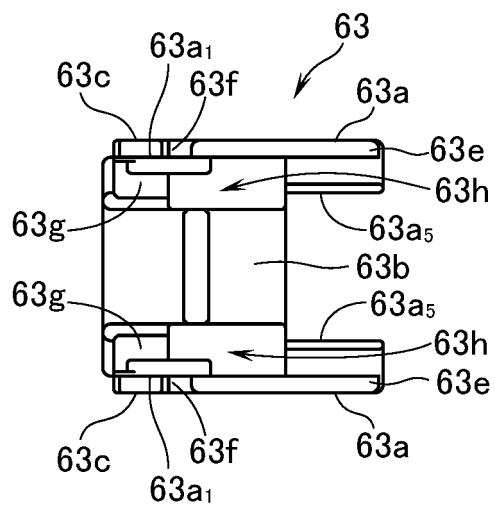


FIG.4C

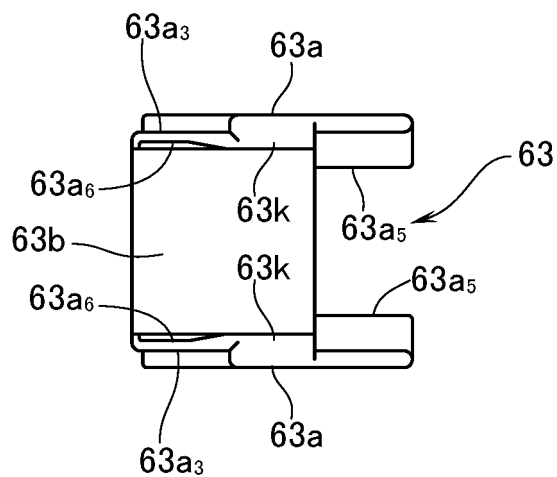


FIG.4D

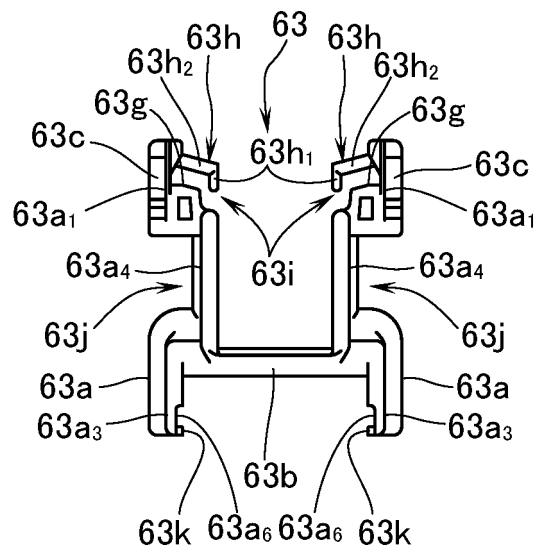


FIG.5A

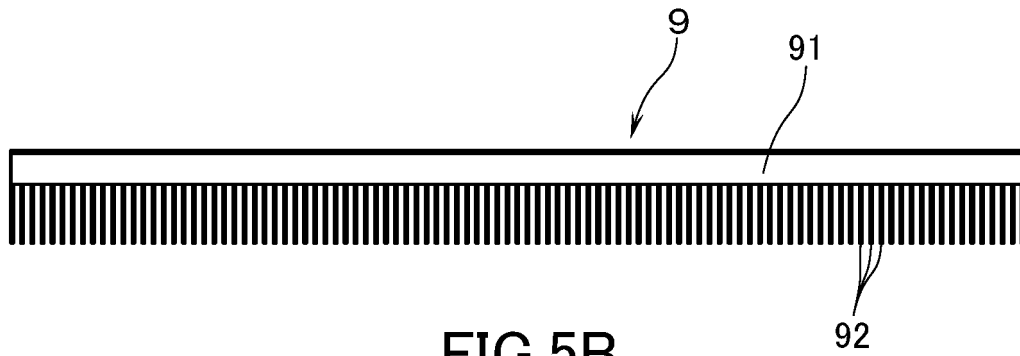


FIG.5B



FIG.6

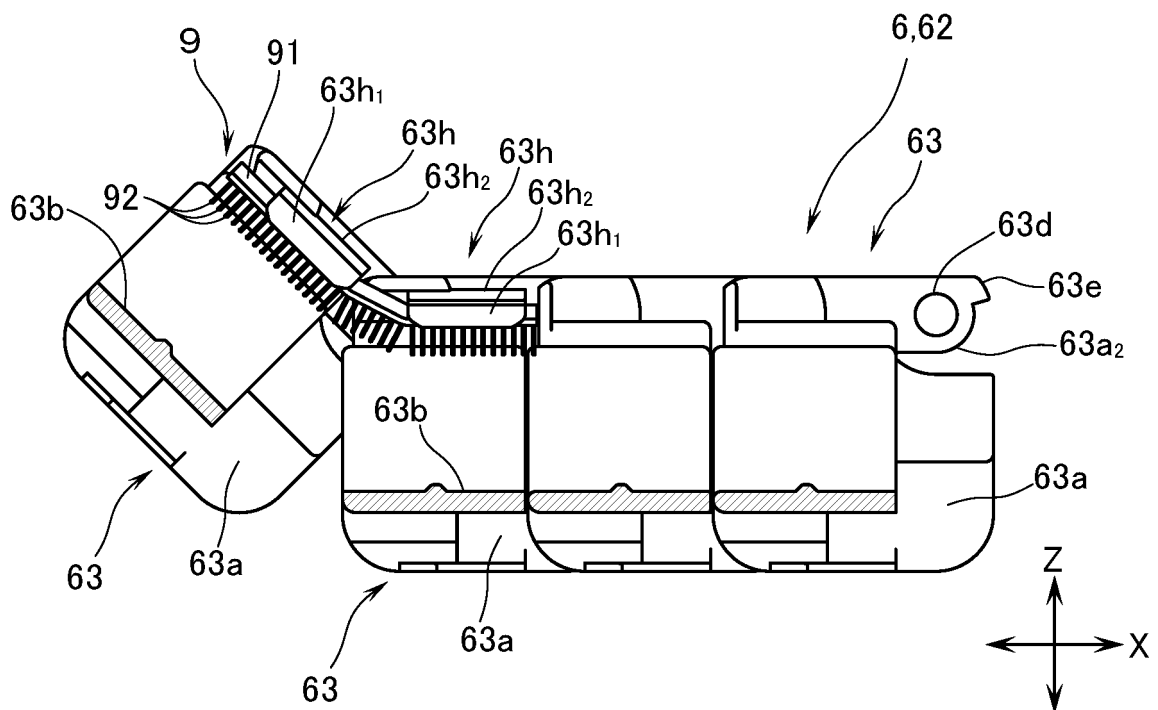


FIG.7

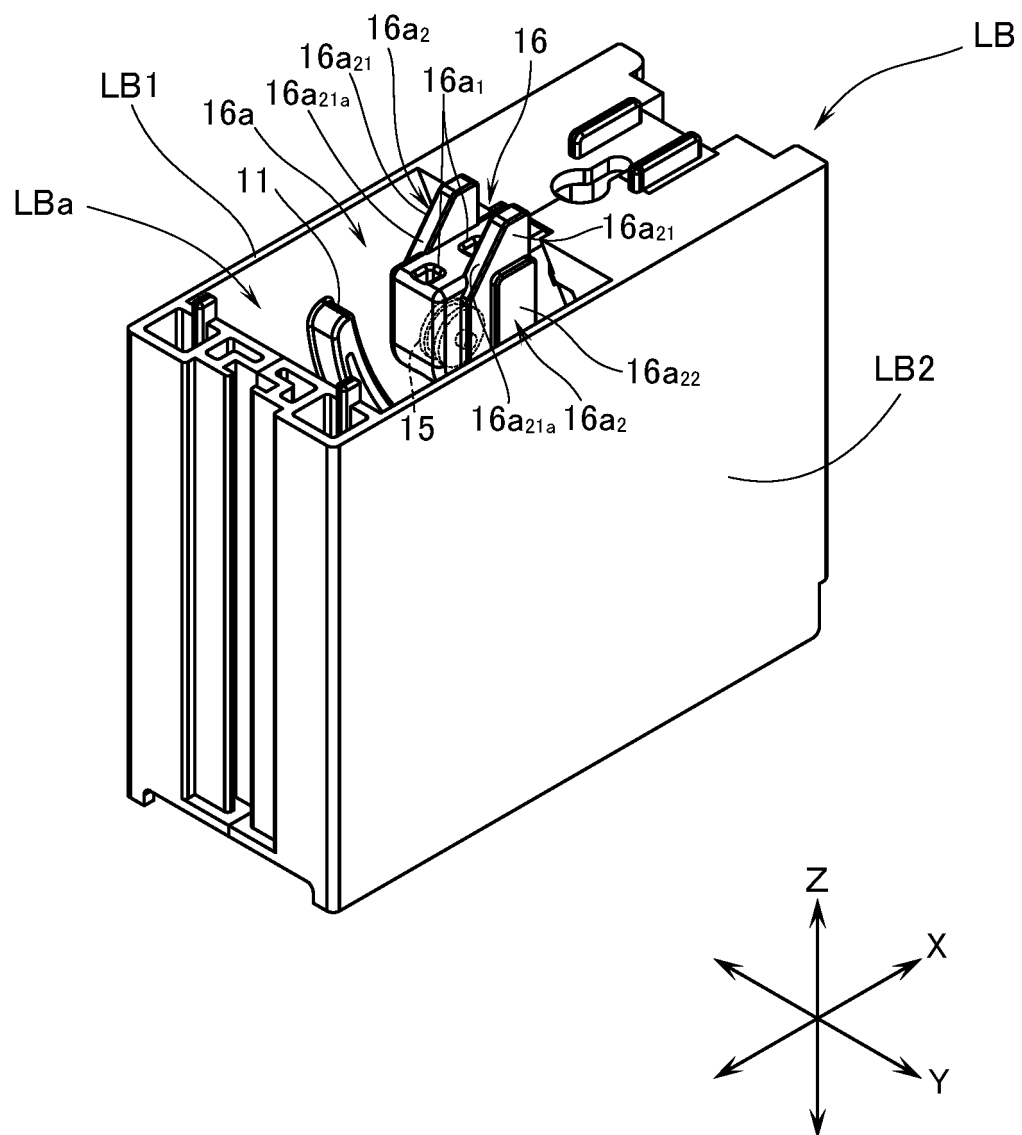


FIG.8

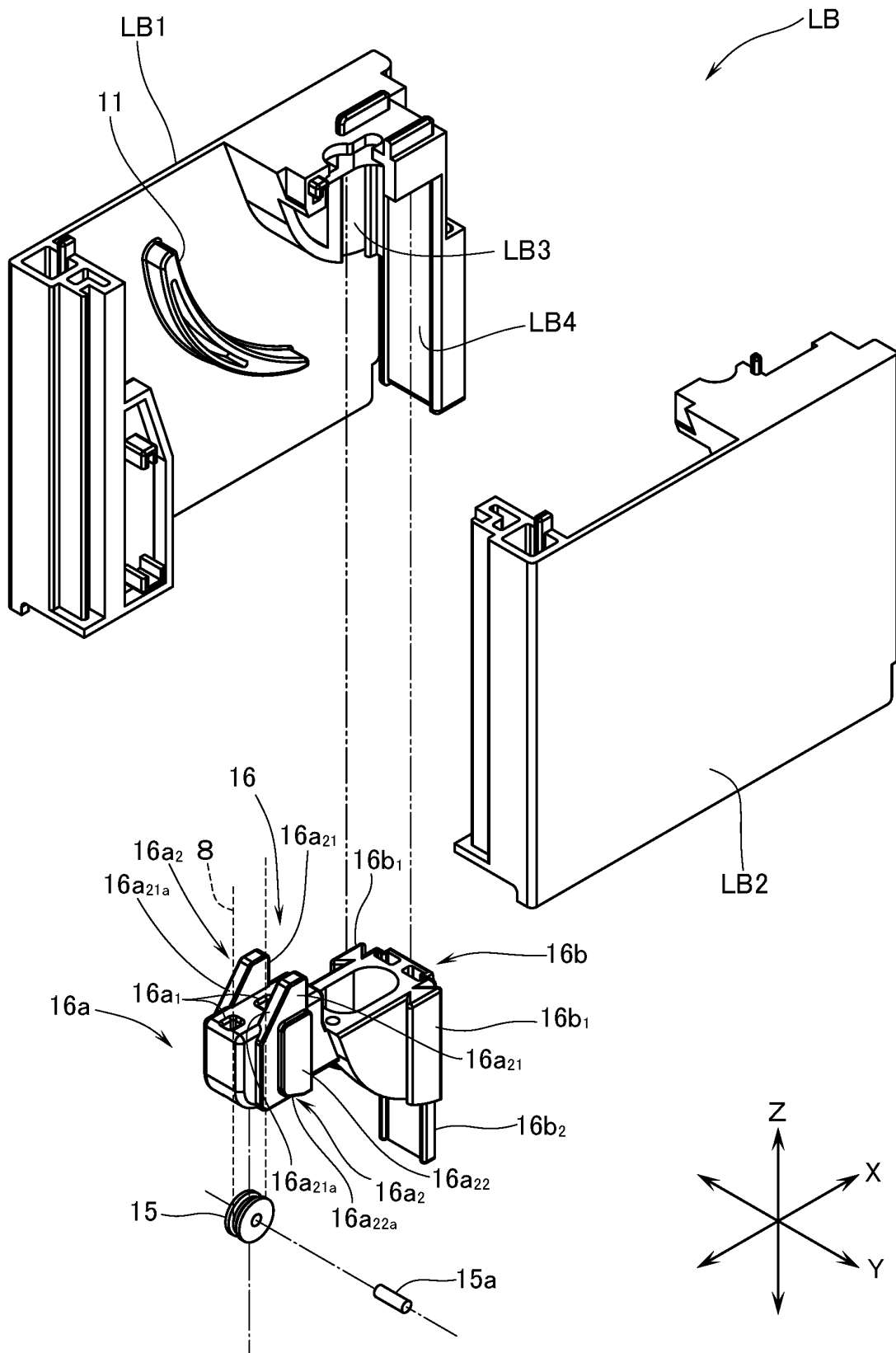


FIG.9

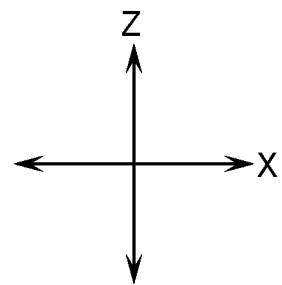
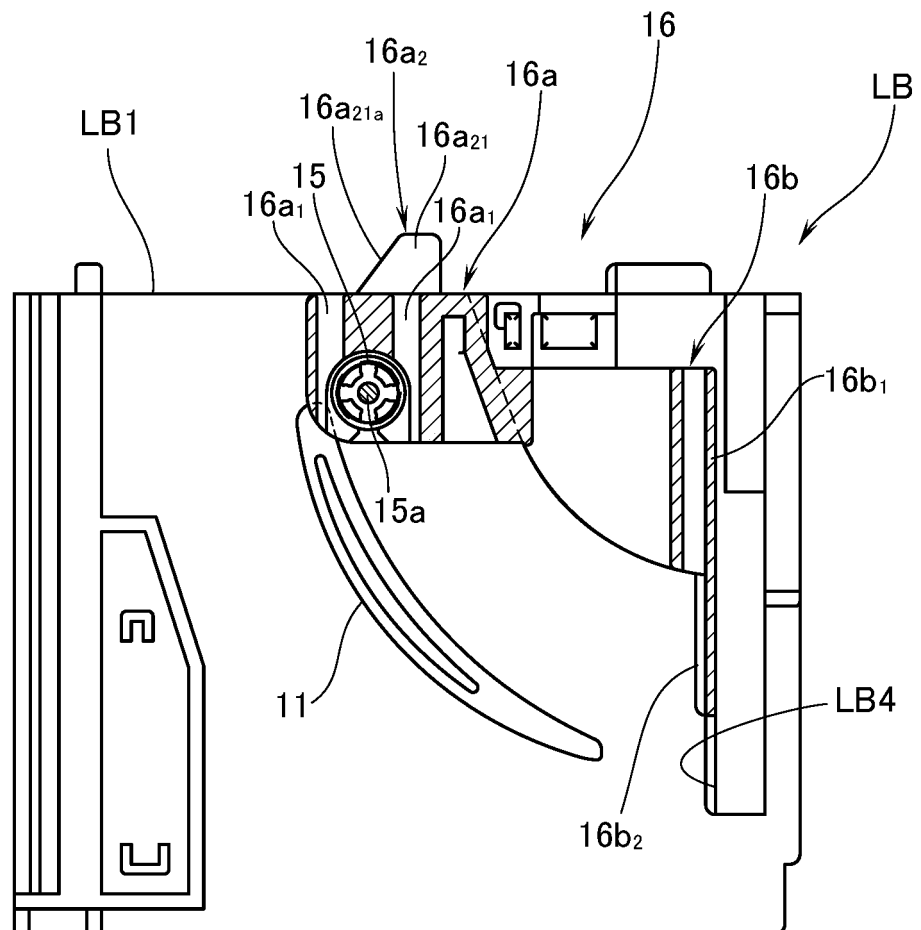


FIG.10

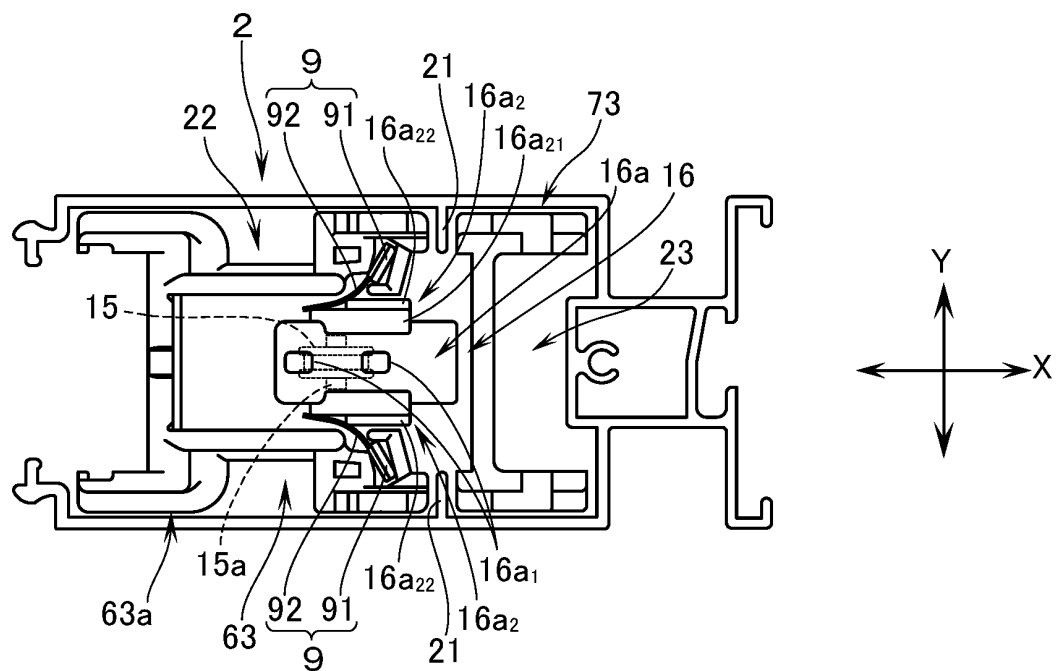
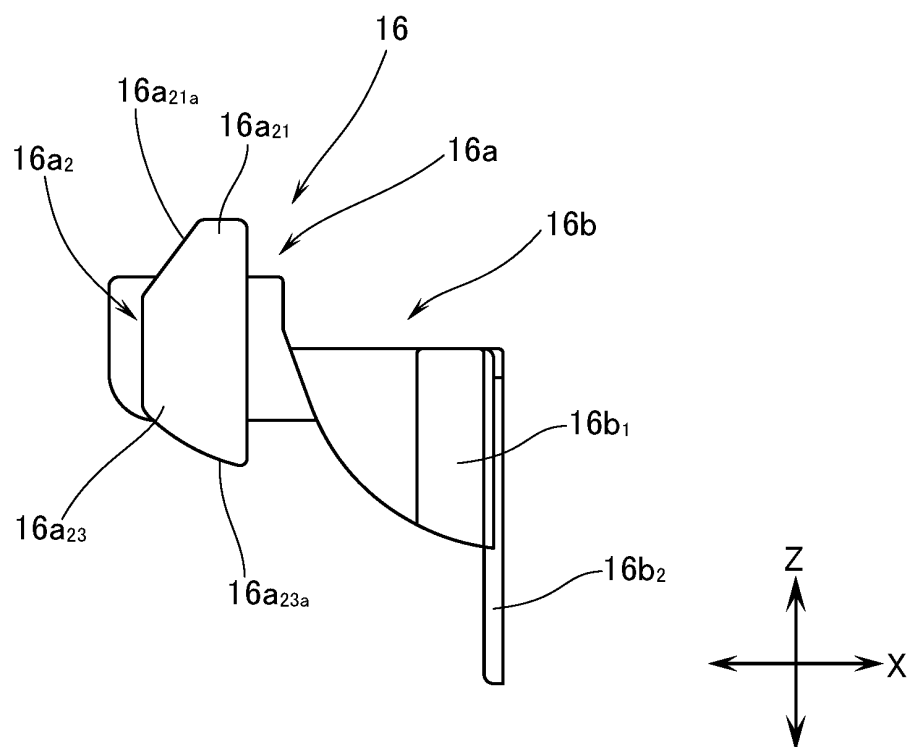


FIG.11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/019998

A. CLASSIFICATION OF SUBJECT MATTER

E06B 9/54(2006.01)i

FI: E06B9/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E06B9/54

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2021

Registered utility model specifications of Japan 1996-2021

Published registered utility model applications of Japan 1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 3396101 A1 (DATE SYSTEM S.R.L.) 31 October 2018 (2018-10-31)	1-3
A	WO 2016/189424 A1 (L'ANGELLOTTI, Angelo) 01 December 2016 (2016-12-01)	1-3
A	EP 2407628 A2 (PAPADOPOULOS, Argyrios) 18 January 2012 (2012-01-18)	1-3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search
07 July 2021 (07.07.2021)Date of mailing of the international search report
20 July 2021 (20.07.2021)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2021/019998

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
EP 3396101 A1	31 Oct. 2018	(Family: none)	
WO 2016/189424 A1	01 Dec. 2016	EP 3303750 A1	
EP 240768 A2	18 Jan. 2012	GR 1007359 B	

REFERENCES CITED IN THE DESCRIPTION

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- EP 2333229 A2 [0012]